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(54) Screening apparatus

(57) The apparatus comprises a worm conveyor (13, 14) around which a barrel screen (6) for discrete material size-classification into at least two grades is secured to rotate therewith. The outer edge of the worm flight (14) abuts with the screen (6). The worm conveyor has a loading zone and a discharge zone at opposite axial ends thereof, each having a stationary barrel casing.

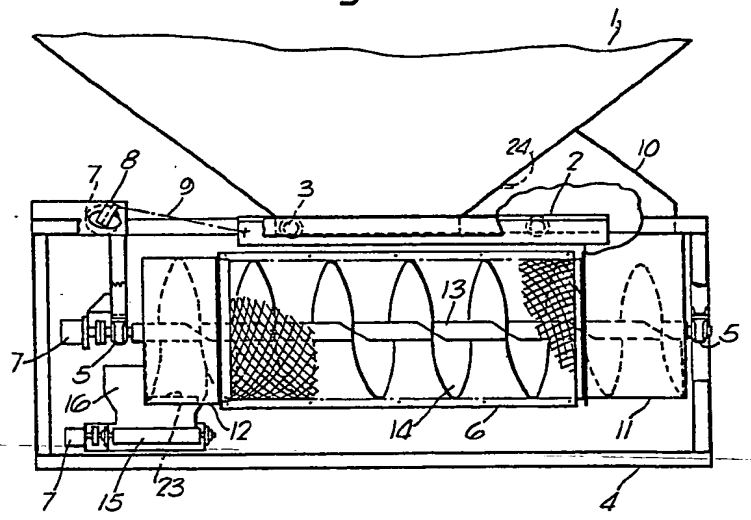
The material is fed from a hopper1 via a plate 2 reciprocated by a crank and connecting rod assembly (8, 9).

The loading casing (11) has an open top with an inlet having an upward surround (11A), and the discharge casing (12) has a discharge outlet (23) formed by an arcuate circumferential cut-out in its lower face.

First removal means (15, 16) and second removal means (not shown) are provided to conduct away respective grades of discrete material.

Hydraulic motors (7) to be driven from a hydraulic power pack are provided to rotate the conveyor and other rotating parts.

Fig.1.



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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

Fig.1.

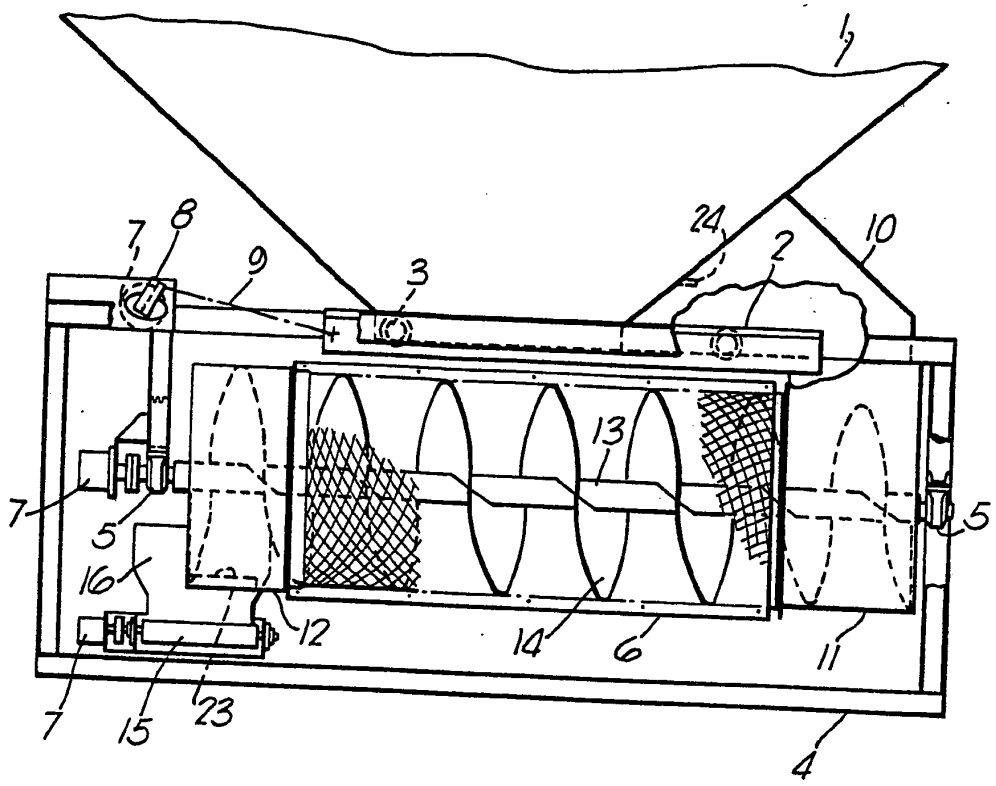


Fig.2.

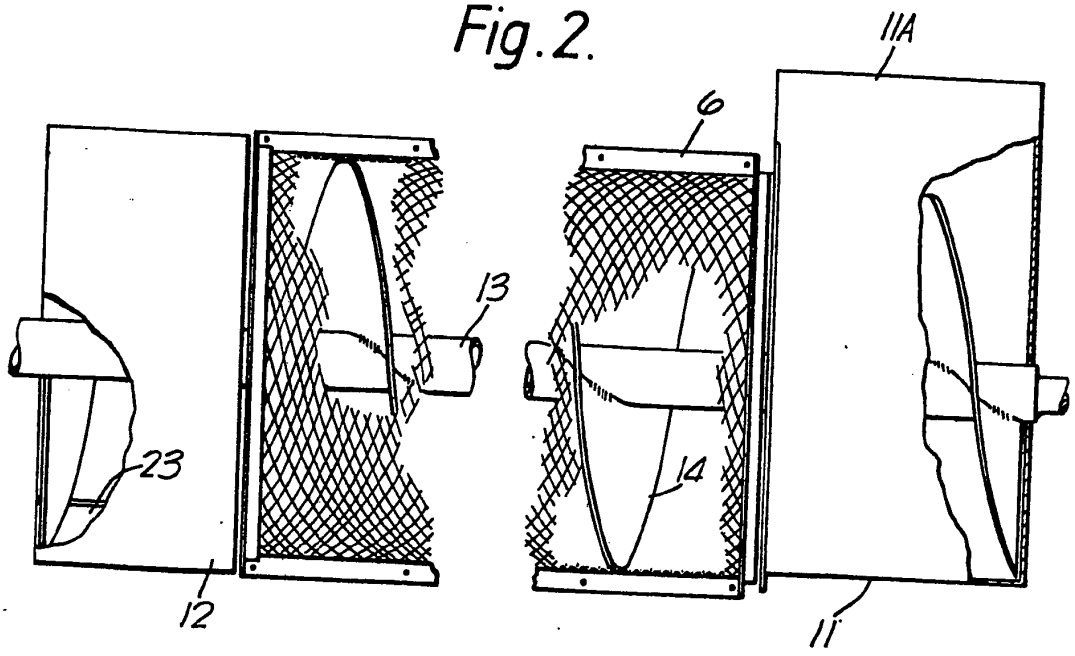


Fig.3.

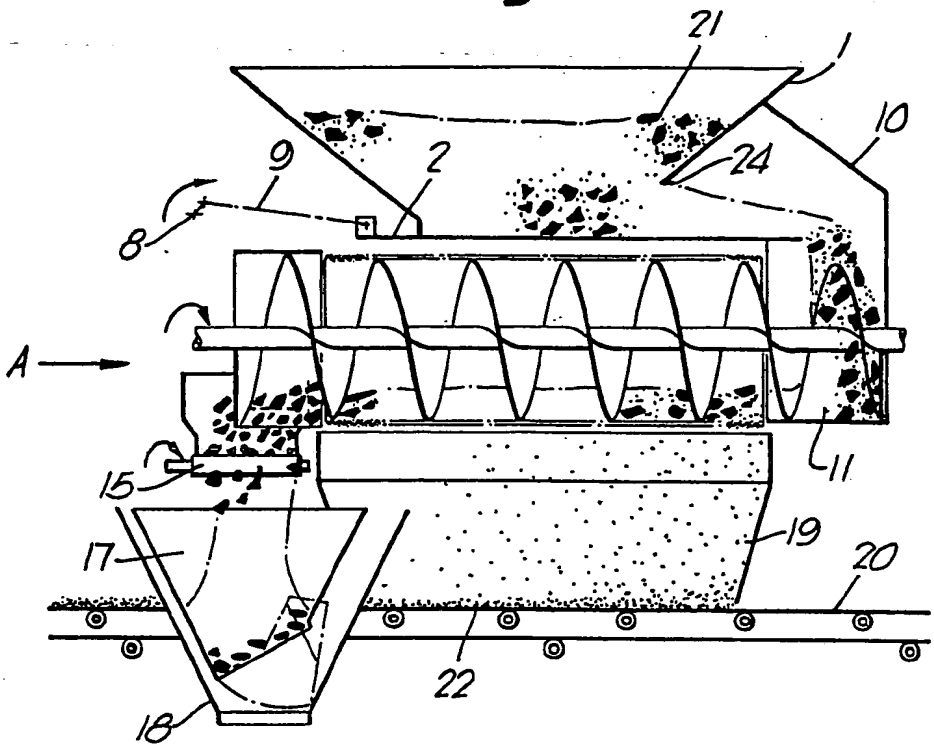
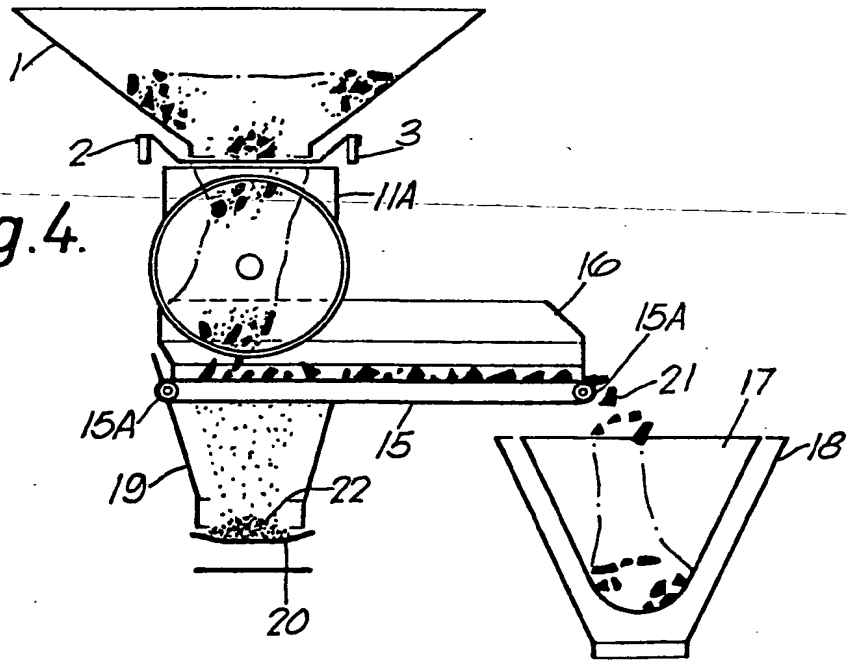


Fig.4.



SPECIFICATION

Screening apparatus

This invention relates to screening apparatus for use in size-classifying discrete material, for example, coal, stone aggregate or sand.

According to the present invention, screening apparatus comprises a worm conveyor around which a barrel screen for discrete material size-classification into at least two grades is secured to rotate therewith, the outer edge of the worm flight abutting with the screen, and power means to rotate said worm conveyor, said worm conveyor having a loading zone and a discharge zone at or near to opposite axial ends thereof, and removal means being provided to conduct away at least one of said grades.

Preferably, the worm conveyor extends beyond the screen and into the loading and discharge zones.

Preferably also, the loading zone comprises a stationary, open-topped barrel casing through which the worm conveyor axially extends with the respective outer end of its shaft projecting through a hole in an end plate of said casing to be journalled in a bearing on a support framework.

Preferably further, the discharge zone comprises a stationary barrel casing through which the worm conveyor axially extends, the casing having a discharge outlet formed by an arcuate circumferential cut-out in its lower face, the respective outer end of its shaft projecting through the open end of the casing to be journalled in a bearing on the support framework.

First removal means preferably comprises an endless conveyor belt mounted below the discharge outlet to transport the discharge therefrom for further processing, for example to a bagging apparatus. Second removal means preferably comprises a discharge chute mounted under the screen-covered part of the worm conveyor, and feeding onto the endless conveyor belt for removal of the material falling through the screen to, for example a stockpile.

Discrete material supply means preferably comprises a hopper mounted at a higher position than the worm conveyor and under whose outlet is a feeder plate adapted for reciprocatory movement to transfer discrete material from the hopper outlet to the loading zone of the worm conveyor.

In general, within the coal handling field at or for retailer trade, all gravimetric filling machines which are used to sub-divide a bulk product into loads of predetermined mass by automatic weighing, use low or high frequency vibrated flat deck screens to achieve screening and feeding to the weighing apparatus and bagging apparatus. A slow down in feed for the purpose of achieving accurate final weight is accomplished by mechanical gate, timer or two independant feeds.

A disadvantage of flat deck screening in coal handling is the requirement for vibration since this is simultaneously imparted to other parts of the apparatus. While methods and apparatus for weighing have been refined to overcome the vibration problem, nevertheless the use of vibration is hindering the potential use of electronic weighing means.

It is therefore an object of the present invention to provide screening apparatus which obviates the disadvantage of requiring vibration to achieve screening of discrete material.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic side elevation of a screening apparatus according to the present invention with part of the screen cut away for clarity;

Figure 2 is a diagrammatic side elevation of the screening apparatus to a larger scale than in Figure 1 with parts cut away showing details of the apparatus; and

Figures 3 and *4* are respectively schematic cross-sectional side and end views of the apparatus illustrating the paths taken by the two grades of material, the end view being in the direction of arrow A of the side view.

Referring to drawings, the screening apparatus comprises a worm conveyor formed from a shaft 13 having a worm flight 14 spirally secured therearound. A barrel screen 6 formed in two longitudinal halves is secured by clamping around the central portion of said worm conveyor with the outer edge of the flight 14 abutting the inside screen surface. The screening surface of said screen is of netted material whose mesh size is determined by the size of material above and below which the discrete material is to classified. A loading zone and a discharge zone are provided at opposite outer portions of said worm conveyor. At each zone, a stationary barrel casing is provided with an end plate remote from the screen. Each end of the shaft 13 projects beyond the respective zone to be journalled in a bearing 5 provided on a support framework 4 on which said apparatus is mounted. The loading casing 11 has an open-top with an inlet having an upward surround 11A, and the discharge casing 12 has, in its lower face, a discharge outlet 23 formed by an arcuate circumferential cut-out at and opening into the open discharge end of the casing. There is clearance between both casings 11, 12 and the worm conveyor sufficient to allow for the worm conveyor to rotate but near enough to prevent any material, passing from the loading zone into the conveyor and from the conveyor into the discharge zone, to fall therefrom.

First removal means, (Figures 3 & 4) comprises an endless conveyor belt 15 arranged around two spaced rollers 15A in a cross feed position as shown. A conveyor side plate 16 upstands from each side of said belt 15 as shown, the plate 16 on the discharge side being cut-away where the discharge casing 12 impinges thereinto. The belt is to convey the discharge from the discharge outlet 23 to a weighing and bagging apparatus comprising generally a weighing hopper 17 suspended in a bag chute 18 around the bottom opening of which a bag (not shown) can be held to receive the contents of the hopper 17.

Second removal means (Figures 3 & 4) comprises

a discharge chute 19 mounted under the screen covered portion of the worm conveyor and feeding onto an endless conveyor belt 20 therebelow for removal of the material falling through the screen to, for example stockpile. The endless conveyor belt 20 is arranged around two spaced rollers (not shown), one of which is driven, and a series of troughing rollers are spaced apart therebetween to impart a concaving (Figure 4) to the upper flight of said belt 20.

Discrete material supply means comprises a hopper 1 mounted at a higher position than the worm conveyor (in this embodiment directly above) and immediately under whose rectangular outlet is a feeder plate 2 adapted for reciprocatory movement in a horizontal or near horizontal plane to transfer discrete material from the hopper outlet to the loading zone of the worm conveyor as shown. The feeder plate 2, of shape as shown in Figure 4, is supported by and runs on wheels 3 provided on the framework 4, and is reciprocated by a connecting rod 9 pivoted thereto and mounted on a crankshaft assembly 8 as shown whereby rotation of the crankshaft 8 is converted by the rod 9 to linear motion of the plate 2. Adjacent to the hopper outlet, a gate 24 is provided over an opening in the inclined side of the hopper towards which the plate 2 outwardly reciprocates. The gate 24 can be adjusted to vary the size of the opening. On each side of this gate 24 and the loading zone of the worm conveyor, wing guide plates 10 are provided as shown to direct the material into the casing 11. The shaft 13 of the worm conveyor is driven by a hydraulic motor 7, as is also the crankshaft 8 and one of the rollers 15A. The three motors 7 are driven by a hydraulic power pack (not shown). The motors and power pack form the power means.

The above-described apparatus provides a method of screening which uses a ratio of linear feed to screening surface area proportional to pitch and diameter of a worm flight.

In use, discrete material, such as coal, is fed into hopper 1. The flow of material therefrom after the motors are energised is from the hopper on to plate 2 through the opening at gate 24 to fall therefrom into the loading casing 11 from whence it is conveyed by the worm conveyor along its length for the residue to be fed through discharge outlet 23 onto belt 15 and to weighing hopper 17 and bagging chute 18. The rate of discharge from the worm conveyor and the speed of delivery of the belt is determined by variable speed control of respective motors 7 to give an accurate final weight. The finer grade of material falling through the screening surface is directed by discharge chute 19 to conveyor belt 20 for conveying to stockpile.

The rate of reciprocity of the plate 2 (determining feed of material to loading casing) is achieved by a variable speed control of the respective motor 7. The function of the discharge outlet 23 is to give a spread of material, being discharged, on the conveyor belt 15 as shown in Figure 3.

In a modification, the screening surface may have a series of two or more different netted materials each having a different size of mesh. The materials are formed together to correspond with the helical compartments of the worm conveyor. Separate discharge chutes for the different grades of material classified by the screening surface are provided in place of the single chute 19. Also, these chutes may each feed onto a different endless conveyor for separate stockpiling. A bank of screening apparatus can be formed into one unit.

Other variations and modifications can be made to the apparatus described above without departing from the scope of the invention.

CLAIMS

1. Screening apparatus comprising a worm conveyor around which a barrel screen for discrete material size-classification into at least two grades is secured to rotate therewith, and power means to rotate said worm conveyor, said worm conveyor having a loading zone and a discharge zone at or near to opposite axial ends thereof, and removal means being provided to conduct away at least one of said grades.

2. Screening apparatus as claimed in Claim 1, wherein the outer edge of the worm flight abuts with the inside face of the screen.

3. Screening apparatus as claimed in Claim 1 or 2, wherein the worm conveyor extends beyond both ends of the screen and into the loading and discharge zones.

4. Screening apparatus as claimed in Claim 1, 2 or 3, wherein the loading zone comprises a stationary, open-topped barrel casing through which the worm conveyor axially extends with the respective outer end of its shaft projecting through a hole in an end plate of said casing to be journalled in a bearing on a support framework.

5. Screening apparatus as claimed in Claim 1, 2, 3 or 4, wherein the discharge zone comprises a stationary barrel casing through which the worm conveyor axially extends, the respective outer end of its shaft projecting through the open end of the casing to be journalled in a bearing on the support framework.

6. Screening apparatus as claimed in Claim 5, wherein the discharge casing has a discharge outlet formed by an arcuate circumferential cut-out in its lower face.

7. Screening apparatus as claimed in any one of the preceding Claims, wherein first removal means comprises an endless conveyor belt mounted below the discharge outlet to transport any discharge therefrom for further processing.

8. Screening apparatus as claimed in Claim 7, wherein a weighing and bagging apparatus is provided at the discharge end of the conveyor belt of the first removal means.

9. Screening apparatus as claimed in Claim 8, wherein the weighing and bagging apparatus comprises a weighing hopper suspended in a bag chute around the bottom opening of which a bag to receive discharged material can be held.

10. Screening apparatus as claimed in any one of the preceding Claims, wherein second removal means comprises a discharge chute mounted under

the screen-covered part of the worm conveyor, and feeding onto the endless conveyor belt for removal of the material falling through the screen.

11. Screening apparatus as claimed in any one of the preceding claims, wherein discrete material supply means comprises a hopper mounted at a higher position than the worm conveyor and under whose outlet is a feeder plate adapted for reciprocatory movement to transfer discrete material from the hopper outlet to the loading zone of the worm conveyor.

12. Screening apparatus as claimed in any one of the preceding claims, wherein the screen has a series of two or more netted materials each having a different size of mesh, the netted materials being formed together to correspond with the helical compartments of the worm conveyor, and each being serviced by a separate discharge chute located to receive the respective grade of material passing therethrough.

13. Screening apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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